C. Remarks

The claims are 1-3, 5, 10-13 and 30, with claims 1 and 30 being independent. Claim 9 has been cancelled. Claim 1 has been amended to clarify the invention in accordance with the specification and cancelled claim 9. Claim 30 has been rewritten so that it depends from claim 1 and recites additional components of the apparatus. Support for the amendment may be found, inter alia, in the specification at page 24, lines 9-17, page 26, line 13 - page 27, line 9, and in Fig. 1. No new matter has been added. Reconsideration of the present claims is expressly requested.

Claims 1-3, 5, 9-13 and 30 stand rejected under 35 U.S.C. § 103(a) as being allegedly unpatentable over U.S. Patent No. 5,525,446 (Sypula) in view of JP 4-255332 (Mitsubishi). This rejection is respectfully traversed.

Prior to addressing the merits of rejection, Applicants would like again to briefly point out some of the key features and advantages of the presently claimed invention. The present invention is related to an endless belt. This belt can be used in an electrophotographic apparatus. Specifically, a toner image formed on the photosensitive member is transferred to the belt by applying a first transfer bias and is then transferred from the belt to an image-receiving material by applying a second transfer bias. The endless belt comprises a conductive agent and a thermoplastic resin having a diphenyl sulfone structure represented by formula (1) and having a resistance of 1×10^0 to 1×10^{14} Ω. The endless belt is produced by:

providing an extrusion material having a breaking extension of 2% or more and a tensile breaking strength of 40 MPa or more and comprising the thermoplastic resin;

extruding the extrusion material in a molten state through a circular die having a given external diameter and slit-width; and

subjecting the extruded resin to a scale-up inflation by air blowing or drawing the extruded resin by applying tension and forming a seamless belt having a thickness not larger than 1/3 of the slit-width of the circular die and an external diameter from 105% to 400% of the external diameter of the circular die.

In applying the seamless belt have excellent strength to the intermediate transfer member used in the electrophotographic apparatus, Applicants' strived to reduce unevenness in electrical resistance and the thickness of the seamless belt. As a result of the extensive study conducted by Applicants, it was found that this goal can be achieved by defining the physical properties of the extrusion material and the degree of the scale-up inflation of the resin or the drawing of the resin under tension after the extrusion.

Sypula discloses an intermediate transfer member including a base layer and a top thermoplastic film forming polymer layer. It discloses 4,4'-dihydroxy-diphenyl-sulphone as an example of the material for the base layer. In addition, this reference mentions that extrusion is one of methods of forming the base layer and discloses that the intermediate transfer member may be in the form of an endless belt. However, Sypula does not disclose or suggest that the base layer is produced through a process step, which is a pre-condition for the production of the intermediate transfer member of the present invention, i.e., the step of subjecting the extruded resin to a scale-up inflation by air blowing or drawing the extruded resin by applying tension.

As mentioned above, one of the goals of the present invention is to reduce or prevent uneven thickness or uneven electrical resistance of the seamless belt while still producing a seamless belt having excellent strength. Sypula, however, is not cognizant of the technical problem the present invention is attempting to solve and does not disclose a forming method that includes the presently claimed pre-condition step.

In the Office Action mailed in April 11, 2001, the Examiner alleged that the present invention is obvious over Sypula and Mitsubishi, because the circular die that is not disclosed by Sypula is conventional and the determination of its external diameter is an optimization and because Mitsubishi discloses a method of extruding a resin from a circular die. However, the forming conditions employed in the present invention, such as controlling the seamless belt thickness to be not larger than 1/3 of the slit-width of the die and setting the seamless belt external diameter to 105% to 400% of the external diameter of the circular die, are important parameters in obtaining the intermediate transfer member having excellent strength and uniform thickness and resistance, which member is able to transfer high-quality images to an image-receiving material. Clearly, the presently claimed forming conditions and physical characteristics are not an optimization. This is further demonstrated by the following Comparative Examples, which show unexpected, superior results associated with the presently claimed invention.

Comparative Example 1

The same materials and the same apparatus as those in Example 1 were utilized, except that a circular extrusion die having a diameter of 120 mm and a die gap of

0.8 mm was used and the amount of the materials to be heated and extruded was increased.

In the same manner, an intermediate transfer belt was produced with a diameter of 190 mm, a belt width of 320 mm and a thickness of 291μm, which exceeds 1/3 of the die gap. This is designated as an intermediate transfer belt (5).

The electrical resistance of this intermediate transfer belt (5) under the application of 100 V was 1 x 10^6 Ω and the deviation in electrical resistance in the surface direction was within one figure. However, the deviation in electrical resistance in the thickness direction was 1.5 figures. The deviation in thickness increased to 291 μm ± 49 μm.

Next, using this intermediate transfer belt (5), printing was tested in the same manner as in Example 1. Uneven images and spots around line images occurred from the initial stage. Moreover, cracking occurred on the belt from its end portion at the 39,000th sheet of the running test, and hence the subsequent test was stopped. As a result, it was determined that even when the same materials as in Example 1 were used, if the intermediate transfer belt was produced under the conditions not satisfying the forming conditions employed in the present invention, the deviations in thickness and electrical resistance of the belt increased and the durability of the belt became insufficient.

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Comparative Example 2

The same materials and the same apparatus as those in Example 4 were utilized, except that a circular extrusion die having a diameter of 280 mm and a die gap of 0.8 mm was used and the amount of air blown from the gas inlet passage 150 was

decreased when the materials were heated and extruded. In the same manner, a transfer material carrying belt was obtained with a diameter of 280 mm, which is equivalent to 100% of the die diameter, a belt width of 250 mm and a thickness of 195 μm. This is designated as a transfer material carrying belt (2).

The electrical resistance of this transfer material carrying belt (2) under the application of 100 V was 2 $x10^{12}$ Ω and the deviation in electrical resistance in the surface direction was within one figure. However, the deviation in electrical resistance in the thickness direction was 1.2 figures. The deviation in thickness increased to 195 μm ± 42 μm.

Next, using this transfer material carrying belt (2), printing was tested in the same manner as in Example 4. The color misregistration, which is considered to be caused the uneven thickness, was observed from the initial stage. After the running test, in addition to the color misregistration, uneven images were observed. As a result, it was determined that even when the same materials as in Example 4 were used, if the transfer material carrying belt was produced under the conditions not satisfying the forming conditions employed in the present invention, the deviations in thickness and electrical resistance of the belt increased and faulty images occurred.

As shown in the above Comparative Examples 1 and 2, the seamless belts having a thickness and an external diameter outside of the range required by the present invention have large variations in thickness and electrical resistance. As a result, it was difficult to form high-quality images in a stable manner when the intermediate transfer belt made using these seamless belts was included in the electrophotographic apparatus.

Therefore, it is clear from the Comparative Examples that the parameters required by the present invention are not a mere optimization of values, but are important characteristics, which lead to unexpected, superior results.

Furthermore, the Comparative Examples show that the intermediate transfer member obtained by the method of the present invention substantially differs from that formed under the conditions not satisfying those required by the present claims in terms of the product itself. Accordingly, the recitation of the process steps in the claims not only defines the method of producing a seamless belt, but also distinguishes the structure of the seamless belt obtained by that method, i.e., substantially defines the structure of the seamless belt. Thus, Applicants respectfully submit that the intermediate transfer member in Sypula is quite different and is patentably distinct from that of the present invention in terms of structure, because Sypula does not disclose a forming method and the physical characteristics as presently claimed.

Mitsubishi cannot cure the deficiencies of Sypula. Applicants have discussed Mitsubishi in detail in the Amendment filed on February 4, 2003. To avoid repetition, Applicants hereby incorporate the comments regarding Mitsubishi from the February 4, 2003 Amendment in their entirety. As mentioned previously by Applicants, like Sypula, Mitsubishi also does not contain any teaching regarding the physical properties of the extrusion material as presently claimed. Accordingly, Mitsubishi, whether considered separately or in combination with Sypula, cannot affect the patentability of the present invention.

Wherefore, Applicants respectfully request that the rejection be withdrawn and the present case be passed to issue.

This Amendment After Final Rejection should be entered, because it places the case in allowable form. Alternatively, it places the case in better form for possible appeal.

Applicants' undersigned attorney may be reached in our New York office by telephone at (212) 218-2100. All correspondence should continue to be directed to our address given below.

Respectfully submitted,

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